DOCUMENT RESUME

ED 358 826 IR 016 106

AUTHOR	Bollier, David
TITLE	The Information Evolution: How New Information Technologies Are Spurring Complex Patterns of Change. Forum Report. A Report of a Conference on the Impact of Information Technology (Aspen, Colorado, August 6-9, 1992).
INSTITUTION	Aspen Inst., Queenstown, MD.
REPORT NO	ISBN-0-89843-132-8
PUB DATE	93
NOTE	31p.
AVAILABLE FROM	Aspen Institute, Communications and Society Program, 1755 Massachusetts Avenue, N.W., Suite 501, Washington, DC 20036.
PUB TYPE	Collected Works - Conference Proceedings (021)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Administrative Problems; Business; Change; *Communications; Conferences; Economic Impact; Futures (of Society); *Information Technology; Models; Organizational Development; Systems Development; *Technological Advancement; Theories
IDENTIFIERS	*Complex Adaptive Systems; *Technological Change

ABSTRACT

Because the summer of 1992 seemed a good time to reflect broadly on the many directions in which the technologies of the new Information Society are moving, the Aspen Institute Communications and Society Program convened a meeting of experts, leaders, and representatives of various information technology interests to lay the groundwork for future, more focused efforts. A significant aspect of the conferences was the use of a new paradigm for thinking about the impact of information technology, that of co-evolving complex adaptive systems. When new technologies are introduced into the workplace or other milieu, they often produce new tensions. These tensions were explored by conference participants. One participant, Murray Gell-Mann, introduced the theory of complex adaptive systems as a framework for understanding technological change. Complex adaptive systems are those that give rise to other systems, which in turn lead to still other systems. Understanding how complex adaptive systems behave offers useful insights into the behavior of contemporary business organizations. The information evolution in American business mimics the theory in many ways as the accelerating rate of communication within the business enterprise illustrates. The most profound impact of information technologies may be that they stimulate the development of new organizational models for understanding business. What the future holds for the complex adaptive systems that are evolving is discussed from the point of view of the market, the government's role, and the promise for change that complex adaptive systems offer. Appendix A lists conference participants, and Appendix B presents the purpose statement of the Communications and Society Program. (SLD)

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The Aspen Institute

Communications and Society

The Information Evolution:

How New Information Technologies are Spurring Complex Patterns of Change

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FORUM REPORT

THE INFORMATION EVOLUTION:

How New Information Technologies Are Spurring Complex Patterns of Change

A Report of
A Conference on the Impact of Information Technology

Aspen , Colorado
August, 6–9, 1992

by
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The Aspen Institute
Wye Center, P.O. Box 222
Queenstown, Maryland 21658
Published in the United States of America
in 1993 by The Aspen Institute

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Printed in the United States of America

ISBN #0-89843-132-8

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FOREWORD

The way we look at the world, our workplaces and ourselves is radically changing. By 1992, "information" has become an organizing concept for looking at cultures around the world. Economists allude to an information economy, one characterized by a majority of workers in a society manipulating symbols of data, information and knowledge. Visionaries speak a new language to describe emerging functions in the new Information Society: symbolic analyzers, systems integrators, knowledge navigators. Our intelligence is becoming "artificial" and our reality "virtual." In short, information and communications processes are central to understanding our very selves.

Central, too, in the whirling pace of change have been the new information and communications technologies. The computer—the machine that changed the world—has become not a machine at all, but a silicon chip, a "microcosm" of immense power. The line of communication is hardly a telephone line anymore, but is becoming a fiber of light, simultaneously carrying information in a variety of media, what George Gilder calls the "telecosm." And in their wake comes a ripple of changes in every institution, from the warroom to the schoolroom, from the workplace to the fireplace, and from the councils of government to the private sanctuaries of the persona.

The summer of 1992, then, seemed to be a good time to reflect broadly on the many directions in which "information technology" is moving. What is the impact of these changes on democratic institutions and values? How might individuals, organizations, and governments affect the likely directions in which the changes in information technology are going?

The Aspen Institute Communications and Society Program convened a meeting of experts, leaders, luminaries, and representatives of affected interests to lay the groundwork for future, more focused efforts. It thus began the process by asking broad questions. What is the impact of information technology in various contexts, namely, society, the workplace and the individual? Will they be likely to foster democratic values? What can be done to affect these trends? How do we begin to approach these questions? What are the proper models of analysis?

The Conference. An extremely diverse and bright group gathered in Aspen, Colorado to address these issues in four sessions, August 6–9, 1992. The list of participants appears at the back of this report. We commissioned journalist David Bollier to write up the proceedings in order to have a foundation from which to build future models and options.

The meeting was probably the most interesting we have held in the two and a half years of my tenure as director of the Aspen Communications and Society Program. In one sense, no report could capture the energy levels, the mutual feelings of respect among all the participants, and the genuine learning from the process. On the other hand, David Bollier's report pulls together some rather interesting themes and concepts that manifested themselves in the readings and at crucial times throughout the meeting.

A New Paradigm. The significant element of the conference, for me, was the use of a new paradigm or model for thinking about the impact of information technology. The communications regulatory field, from which I come, has lived for many years under the Communications Act of 1934. Arising out of the New Deal, the Act establishes a regulatory scheme premised on the federal government's intervention in the telephone and broadcasting industries according to the "public interest, convenience and necessity." For forty years this role was taken seriously, and the controlling paradigm was one of government regulation and intervention.

In the late 1970s this paradigm began to change into a more marketplace dominated regime. New competitive information technologies—computers, video cassette recorders, and audio cassettes—were emerging unregulated, and the government responded by gradually deregulating the established communications industries. Radio, television, cable, long distance, terminal equipment, and satellite industries each became freer to compete both within their industries and intermodally. The paradigm of the 1980s was competition. Indeed, it became "global competition," a watchword to explain a broad variety of governmental or business actions.

More recently, business leaders, government officials, academics and public representatives speak more of cooperation, collaboration, and partnerships. Longtime competitors such as IBM and Apple are forming strategic alliances, and this is happening among companies and industries around the world. In the troubled area of education in the United States, leaders are looking more to public-private partnerships to aid local schools. And even nations are forming new regional trade communities and alliances, such as the European Community and the North American Free Trade Agreement. A new model appears to be emerging for assessing the role of diverse players in a capitalistic democracy, a paradigm of coordination among typically independent entities.

What evolved at the 1992 Aspen Information Policy Conference was another, perhaps more obvious, perhaps more complex paradigm—that of co-evolving complex adaptive systems. (This concept is explained in the ensuing report.)

Indeed the seminar itself became an adaptive system. It began with a variety of thoughts, perspectives and players. As the discussion moved from the technology itself to the cultural, social and personal contexts, a few competing themes or schemata began to emerge. For example, some believed that enlightened business and competition were the crucial vehicles to affect and improve social ills. Others saw a need for more government intervention, and still others advocated the newer collaborative approach as the only way matters would improve. A curve of distribution of influence entered the picture: some participants spoke and affected the discussion more than others. The roundtable format provided nearly constant feedback, and people began to change their outlooks and adapt their views.

We cannot speak for all, and do not try to do so here. But many at the conference began to consider co-evolving complex adaptive systems as a paradigm for the rapidly emerging world of information, information technology, and information-oriented societies. In that way the Communications Revolution might be better regarded as an Information Evolution.

We hope that the ensuing report conveys at least a germ of this, along with the many other ideas contained in it. For, our purpose here is to suggest ideas and concepts upon which others may build. As the Aspen Institute's motto is "thought leading to action," we often suggest a series of options or specific actions to be taken. In this case, we hope simply to add insight to the way people look at our new world of zeros and ones, voices and records, pictures and videos.

Acknowledgments. I want to take this opportunity to thank SHL Systemhouse and Oracle USA for their generous contributions to the Communications and Society Program in order to sponsor this seminar, Jerry Murdock of the Aspen Technology Group for his help and energy in organizing the event, Cathy Clark, our former Program Coordinator, for administrating the conference and for her editorial help on the report, Stuart Brotman for his assistance in compiling and editing the background readings, David Bollier for his excellent-as-usual skills in writing the report, and most especially, each of the participants for taking their valuable time and using such enthusiastic energies to participate in this activity.

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THE INFORMATION EVOLUTION:
How New Information Technologies
are Spurring Complex Patterns of Change

I. Introduction

It is a truism that when new information technologies are introduced into a business or other milieu, they often introduce new disruptions, anxieties and uncertainty. From the workplace to the marketplace to the home, new technologies are transforming familiar practices and challenging received norms of law and social ethics—while offering little guidance about what new norms should prevail.

A primary purpose of this conference was to identify some of the more salient tensions that information technologies are provoking in modern life today. Beyond simply identifying these tensions, the conference sought to explore new ways to resolve, or somehow get beyond, the growing conflicts engendered by new information technologies.

A. *New Tensions Generated by Information Technologies*

Charles Firestone, Director of The Aspen Institute's Communications and Society Program, briefly described some of the more enduring conflicts that new information technologies are bringing to the fore. These include:

- *Centralization vs. fragmentation.* The new technologies make it increasingly possible for business and government to centralize control over information, sometimes at the expense of employees, citizens and consumers. Yet new technologies can also diffuse and even democratize power, to the extent that the technology makes information more plentiful and accessible. What factors can influence the direction that new technologies take?

- *A holistic perspective vs. specialized knowledge.* As new innovations in technology proceed apace, specialization of knowledge and job categories has become the norm. Yet as computing and telecommunications systems penetrate into ever more diverse areas of business, society and personal life, a more general, synoptic perspective is needed. Unfortunately, the mechanisms or forums for integrating disparate technological developments into a larger, holistic framework of understanding hardly exist.

- *Too much information vs. too little wisdom.* The awesome capacity of the new technologies to generate raw data makes it theoretically possible to make

wiser choices. But the sheer volume of information being generated are making it necessary to develop new tools for editing and interpreting information. More attention must be paid to the biases used in generating information; to the screening processes used in distilling information; and to the methods used in interpreting information.

- *Leadership vs. followership.* New information technologies can disrupt traditional lines of authority and render conventional styles of leadership ineffective. e-mail, for example, may promote a more egalitarian, democratic ethos within a business enterprise, and other information systems also tend to undermine rigid bureaucratic hierarchies. What changes does this portend for corporate leadership? What are the implications for employees?

- *Worker isolation/alienation vs. community connections.* Information technologies can enable management to increase its surveillance and control of the workforce, exacerbating the isolation and impotence of employees. Alternatively, management can choose to deploy new technologies in ways that enhance a sense of community and autonomy, or indeed, in ways that make new kinds of community possible.

- *Sharing vs. withholding access to information.* Because information technologies open up new highways of interaction—between managers and employees, between marketers and consumers, between government and citizens—traditional notions of privacy are being undermined. How should privacy be re-conceptualized in light of new information technologies? What new principles should prevail?

- *Information "filters" vs. disintermediation.* Information technologies often provide the means for citizens to "leapfrog" over intermediaries such as political parties, the press and representative legislatures. The lines of connection between citizens and politicians, voters and policymaking, and TV viewers and news events, are becoming more direct and unmediated. Is this good and desirable? And if not, what sorts of "filters" are appropriate, and why?

- *Public intervention vs. private decisionmaking.* The public has many legitimate concerns about how new information technologies are deployed, given their profound impact on economic development, the rights of workers and consumers, and individual privacy. When is public intervention appropriate, in the form of regulation, subsidies, government purchasing, and re-allocations of legal rights? And when should private investors, businesses and managements retain full control of the development of a given technology?

For people who care about the tensions enumerated above, a common reaction is to propose one or another action plan, in the hope of guiding the course of future

The New Threats to Privacy

By fundamentally altering the ways that personal information is collected, controlled, and circulated, information technologies have essentially redefined the nature of "privacy." According to Professor Stefano Rodotà of the University of Rome, privacy is no longer "the right to be left alone"—the famous formulation by Justice Brandeis which stresses secrecy about private information. The more relevant concept today, in light of information technologies, is "the right to maintain control over one's own data," says Rodotà.

This shift has occurred because information technologies have "reconstructed" a new sphere of privacy that differs qualitatively from that which exists in, say, a small town. In small, personal milieus, a person has greater discretion over his or her "public" actions. In modern mass society, however, a person who uses a telephone or credit card, who subscribes to magazines, or who makes mail-order purchases, immediately surrenders control over a great deal of private information. This information, in turn, may end up in the hands of marketers, prospective employers, banks, and others who find aggregations of financial, demographic, and lifestyle data useful. By losing control over such personal information, individuals can be harmed by the circulation of erroneous information, or may be deluged with unwanted direct mail and telephone solicitations.

Current trends in information technology are not likely to strengthen a person's rights of privacy. As Professor Rodotà explains, "The information society now takes the form of a 'society of services' with a high degree of standardization and growing international links. This leads to two consequences: the more the services are technologically sophisticated, the more the individual leaves a considerable amount of personal data in the hands of the supplier; the more the network of services expands, the greater the possibility of links between data banks and of the international circulation of the data gathered."

"The fundamental issue here," writes Esther Dyson, Editor and Publisher of *Release 1.0*, "is the inequality of power between the individual and all institutions: marketers, employers, government agencies. The problem is that all big organizations come to resemble each other in their power over citizens and their impenetrability. Even without meaning to, they can make someone's life hell. And when they do go after someone, they have huge resources unmatched by any citizen—whose only recourse may be to go to another bureaucracy."

The question provoked by these developments is whether information technologies are making privacy a commodity, for better or worse, while exacerbating the chasm between information haves and have-nots. Should the resolution of conflicting interests be resolved by new legal norms mandated by Congress and the courts? Or should the marketplace be left to devise its own protections?

European nations are more likely than the United States to uphold an inalienable right of personal privacy, beyond the reach of commerce or government. In 1984, German courts declared a fundamental citizen right of "informational self-determination." The European Community, through two directive bills, has chosen to ensure citizens a "high degree of protection" of their personal data, whether controlled by government or business. As Denis Zervudacki, Secretary General of the National Center for French Employers, said, "A man who is informed is a citizen. A man who is not informed is a subject."

Whether the issue is "caller identification" for telephones or security breaches of corporate data bases, technological advances are frequently outpacing the received categories of law and custom. Necessarily, a new conceptual framework must be devised to re-define privacy and privacy protection in the information age.

developments. But if one lesson has become clear over the past two decades, it is that information technologies do not easily conform to original intentions and plans; all sorts of unexpected adaptations emerge as the technologies interact with the human, economic and social environment in a dynamic, iterative manner.

If technological development is relatively fluid and unpredictable over time, is there some way to understand how information technologies evolve? Could insights into this process help resolve the legal, political and ethical tensions to which information technologies have contributed, and foster a new equilibrium?

One conference participant, Dr. Murray Gell-Mann, suggested just such a framework for understanding technological change—the theory of "complex adaptive systems." This theory, originating in a scientific context, seems to have great relevance for the evolution of information technologies, business organization, markets and democratic governance.

B. *The Theory of Complex Adaptive Systems*

Dr. Gell-Mann is the Millikan Professor of Theoretical Physics at the California Institute of Technology and the winner of the 1969 Nobel Prize in physics for his work that led up to his discovering and naming "quarks." He is also a co-founder of the Santa Fe Institute (SFI), an independent, nonprofit research organization dedicated to understanding the behavior of "complex systems" and how they arise from simple underlying laws.

There are two types of complex systems, explained Dr. Gell-Mann. Those of the first type have no apparent capacity for such processes as learning or biological evolution; they are exemplified by turbulence in fluid flow and by the evolution of stars and galaxies. Those of the second type are capable of adaptive behavior and are called complex adaptive systems; they are the ones of primary concern to participants in this conference.

On earth, there is a huge variety of complex adaptive systems, each of which is connected in some way to terrestrial life, said Dr. Gell-Mann. Typically, complex adaptive systems give rise to other such systems, and those in turn give rise to still others, and so on. Familiar examples are the chemical reactions that produced life billions of years ago; biological evolution, which has taken place ever since; organisms themselves and the ecological systems that they form; mammalian immune systems; learning and thinking in animals, including humans; the evolution of human societies, in which institutions, customs, traditions and myths function as a sort of cultural DNA; the scientific enterprise, where theories evolve that explain observations and predict new ones correctly; the programming of computers to evolve strategies, for example, for winning games; and the history of the human race in its interaction with itself and with the rest of the biosphere, a history that is now testing more than ever how co-adaptive human beings and other organisms really are.

One illustration of the way in which complex adaptive systems spawn others is the tendency for systems to form themselves into larger aggregate systems involving new levels of organization and cooperation. Multicellular organisms are an obvious example of such aggregates, as are business firms, but so are human institutions for governance on larger and larger scales, now including many that are

transnational and even global. While a market operating under laissez-faire conditions is an example of a complex adaptive system composed of co-adapting agents, so is a market subject to rules that deal with externalities or the cost of information or with possible conspiracies in restraint of trade. The establishment and development of the institutions for governance are just another form of adaptation.

Despite their variety, all complex adaptive systems seem to operate according to common principles. A given system does not simply record its experiences; it identifies regularities in those experiences (to the extent that there are any) and encapsulates those regularities in highly compressed form as a *model* or *theory* or *schema*. "Such a schema is usually approximate and sometimes seriously wrong," said Dr. Gell-Mann, "but it may be adaptive if it can make useful predictions." When activated by additional information, some of it random, a schema unfolds and yields an outcome in terms of prediction and/or behavior. "The outcome of the unfolding leads to events in the real world that affect the survival of the schema or of related schemata," he explained. "That feedback loop is the essential feature of adaptation, evolution or learning."

A basic example of a complex adaptive system at work is the immunological response to a foreign micro-organism invading a mammal such as a human being. The immune system will try to repel the invader with a great many patterned responses that fail to work. But, in a short period of time, hours or days, through a rate of mutation that occurs billions of times faster than in biological evolution, the immune system typically comes up with a chemical response that is effective against the disease carried by the foreign organism. Human learning and thinking operate in a similar fashion. Ideas compete with other ideas; each one leads to explanations and thence to action and outcomes. The outcome determine, to some extent at least, the success of each idea, as a feedback process from the outcome influences the idea's long-term survival or relative standing.

"Each schema must have some degree of stability, but at the same time it is capable of variation, of mutation into other schemata," said Dr. Gell-Mann. "The schemata are all in competition with one another." Particularly interesting cases are self-organizing systems consisting of co-adapting agents, each one trying out schemata for survival in the presence of the others. Ecological systems are examples, and so are economies. There is some evidence that such systems tend toward special situations between order and disorder, with characteristic curves called "power laws" describing, for example, the distribution of resources among the agents. (Here the word "power" refers to a mathematical function like an inverse square or inverse cube, not to power in the usual sense.) If an important organism is removed from an ecological system, the resources in the environment tend to redistribute themselves so as to restore the power law that prevailed before. Perhaps an analogous process takes place in an organization when the removal of middle managers tends to lead to their replacement by specialists at about the same level of pay. (The tendency toward these curves of income, influence and so forth does not imply inevitable extremes of inequality, Dr. Gell-Mann hastened to note, because the power laws may be steeper or flatter. Nor does the tendency of the system to follow certain patterns when left alone necessarily imply that those patterns are desirable.)

C. *Business as a Complex Adaptive System*

The theory of complex adaptive systems seems to offer useful insights into the behavior of contemporary business organizations. If firms are to survive in constantly churning marketplaces, it may be helpful for their members to be aware of how complex adaptive systems behave. Dr. Gell-Mann has written that one of the most important lessons about complex, nonlinear systems in general is that

> . . . they cannot be successfully analyzed by determining in advance a set of properties or aspects that are studied separately and then combining those partial approaches in an attempt to form a picture of the whole. Instead, it is necessary to look at the whole system, even if that means taking a crude look, and then allowing possible simplifications to *emerge* from the work.

This remark, of course, is of particular interest for complex adaptive systems and especially for systems consisting of co-adapting agents if, as is suspected, those agents tend to co-evolve toward a kind of dynamic and resilient situation, in a transition region between order and disorder, with some well-defined mathematical properties.

Dr. Gell-Mann's theory of complex adaptive systems has a powerful appeal not only because it seems to describe countless natural systems. It also complements the recent theories of business organization put forth by analysts such as Peter Drucker and Thomas Malone. The clear implication of either set of arguments is that the business firm of the future must increasingly strive to be flexible, self-adaptive, creative and holistic. Its diverse parts will have to communicate and cooperate among themselves while still working toward a larger common vision. Information technologies can obviously play a significant role here.

The functioning of the Santa Fe Institute itself is a model in this respect. The Institute seeks to overcome barriers between one discipline and another by trying to develop "collaborative generalists." The goal is to "take a crude look at the whole," rather than to intensify specialization within a given discipline, which is the standard, well-rewarded dynamic today.

One important tool that SFI uses to orchestrate its collaborative research projects is information technology—computers, fax, e-mail, phone, as well as periodic person-to-person visits, of course. The idea is to bring together ad hoc research networks of diverse specialists "without extreme localization." Computing systems not only make possible novel forms of professional association. They allow entirely new methods of research—complex computer simulations—that go beyond traditional experimental observation and analytic theorizing, and yield new kinds of qualitative insight into problems.

II. The Information Evolution in American Business

Although American business has not self-consciously adhered to the theory of complex adaptive systems, its behavior in many realms mimics the theory. Businesses are in fact using information technologies to co-evolve into new kinds of organizations. The types of complex, adaptive behavior described by Dr. Gell-Mann can be seen in at least three important areas:

- the increasing coordination of the diverse parts of a business organization;
- the methods by which productivity improvements are pursued; and
- the human adaptations that managers and employees are making in response to new information technologies.

A. *Toward More Efficient Coordination Within Business*

The pervasiveness of information technologies today has changed many basic premises of business management and operations. Information technologies are not simply substituting for human labor, a first-order effect seen in the 1970s and 1980s. Today, as described by MIT Professors Malone and Rockart in the September 1991 issue of *Scientific American*, information technologies have produced important secondary and tertiary effects. These are, respectively:

- An increase in the overall amount of coordination used within businesses. Common examples are the use of computing systems to improve inventory control and to provide greater consumer choice in making airline reservations.
- A shift toward the use of more coordination-intensive structures which link all aspects of a business enterprise, from the production process to suppliers to manufacturing to retailers. A bar-code scanner at a retail outlet, for example, may be used to automatically alert people at the beginning of the manufacturing and shipping cycle to manufacture and ship another unit of a given product.

The growing use of information technologies is prompting some far-reaching changes in business management structures. As technology makes it easier, faster and cheaper to coordinate information, firms are discovering that it can be more efficient and flexible to "outsource" for goods and services rather than generate them from within a firm. Malone and Rockart argue that vertical integration within an enterprise is increasingly less efficient as it becomes feasible to rely on smaller, market-sensitive firms.

As a result of this trend, there may be a greater blurring of the lines that currently separate internal and external business coordination. Inter-business relations may become more collaborative than competitive as information technologies make it both feasible and attractive for firms to pursue long-term strategic alliances.

By introducing more efficient communications, information technologies are also eliminating the need for entire layers of middle management. The corporate management structure is becoming "flatter," as hierarchies are increasingly replaced by "adhocracies"—loosely supervised networks of specialists. Peter Drucker compares the emerging business structure to an orchestra or hospital: top managers directly supervise a range of largely autonomous specialists who "direct and discipline their own performance through organized feedback from colleagues, customers and headquarters." He calls this business structure "an information-based organization."

These various changes in business organization, which were largely impractical if not inconceivable twenty years ago, exemplify the complex adaptive process described by Dr. Gell-Mann. The accelerating rate of communication within the business enterprise and with the market have led to a profound organizational evolution that is still unfolding.

"Knowledge Navigation"—A Solution to Information Overload?

The staggering proliferation of electronic information over the past two decades has spawned a massive problem of its own—how to obtain quick, cost-effective access to the information that one wants?

Over the next decade, predicts Roel Pieper, President and CEO of UNIX System Laboratories, Inc., this problem will require new systems of "knowledge navigation"—software and consultants who can lead people to the information they want. Hoping to meet this growing need, UNIX plans to develop a "seamless" global infrastructure that will enable information requesters to consult with a "help center" and thereby obtain whatever data, images, software, human-to-human consultation, or other information desired. Ultimately, the system will not only provide interconnections between users and providers but serve as a conduit for the demonstration, sale, and distribution of electronic software.

This new network may well bring forth a complementary system of consultants, support services, and distributors who use the network. "Electronically mediated markets [may] assemble armies of 'intellectual mercenaries' virtually overnight," predict MIT Professors Thomas W. Malone and John F. Rockart. These "answer networks" could connect users with a massive array of data bases and a diverse assortment of human experts.

The UNIX system clearly seeks to capitalize on an epochal shift in the information world: As open computer systems are increasingly sold as commodities, demand is burgeoning for task-specific knowledge and software. In an information-rich environment, generating new information may not be as important or lucrative as building the systems for *connecting* users with desired information. Thus, vendors that can understand their customers' real information needs (sometimes known as "subject matter expertise") will probably do better than vendors which conceive of their business merely as the selling of data.

A related, emerging need is for services that can validate the accuracy and quality of information. The very proliferation of information sources (popular press, scientific research, partisan groups, etc.) is creating the need for systems that can evaluate the quality of information. There may be a huge market in the future for companies that can perform and package these functions, much as Data Resources synthesizes, summarizes, and markets economic data or Morningstar provides comprehensive surveys of mutual funds.

B. *Information Technologies and Productivity*

The chief rationale for introducing new information technologies is to raise the productivity of people and the business organization. But now that information systems have penetrated to the furthest corners of businesses, a persistent question keeps cropping up: Is all this information technology actually improving productivity?

The common-sense conclusion is *yes*, says Esther Dyson, editor and publisher of *Release 1.0*, a computer industry newsletter. Yet curiously, most studies show little overall impact on productivity. As Dyson explains, "The problem is that you can show productivity gains in individual cases, but they seem to vanish when you consider the economy as a whole. And even in individual cases, the gains usually dissipate as new techniques and practices percolate through an industry.

So what's the point of all this investment?" Dyson hypothesizes that there are four likely reasons for explaining why "must-be-there" productivity gains are not being measured:

1. As an industry gets more efficient, the benefits are competed away. Visible productivity may go up but profits, the ultimate test, don't.

2. It's a zero-sum game: the benefits to the winners are offset by the losses of the losers in a given industry. But it's still worth it for individual firms.

3. Technology is misused or misapplied.

4. The benefits are offset because the government's increasing "productivity" requires increasing productivity from business, which has to file more forms, obey more laws, take more precautions, generate "prophylactic" documentation, and so forth.

A related puzzle was identified in a recent study by the MIT Sloan School of Management. Researchers found no empirical evidence that information technologies create a sustained competitive advantage for a business enterprise. In some industries, the use of information technologies has become essential for competitive *parity*, such as banks' use of automated teller machines (ATMs). But no sustained competitive *advantage* accrues, the evidence suggested.

Professor Malone clarified an easily overlooked point, that information technology is not itself a form of competitive advantage. It can be used to *leverage* existing corporate advantages in sustainable ways, however, he said. For example, Barclays deZoete Wodd, the British brokerage house, sells a wide range of stocks on the London exchange, a market advantage that was amplified when the company began to reach investors through information technology.

To Gary Fernandes of Electronic Data Systems, Inc., such anecdotes underscore the importance of keeping core business needs and human dynamics foremost in any deployment of information technology. A Japanese retailer, for example, decided to improve its inventory control and merchandising by giving retail clerks "ownership" of assigned shelf space: clerks were given responsibility for keeping shelves fully stocked with the correct items and for monitoring the "through-put" of

products. This strategy was then complemented with the use of appropriate information technologies. The system has reduced ordering errors and out-of-stock items to virtually zero.

Even if productivity gains through information technology are never fully measured, Dyson thinks conventional measurements do not tell the whole story in any case. In today's fast-changing economy, productivity defined as a ratio of output dollars to input dollars may simply be too narrow and misleading. The real goal of business organizations today must be to learn and change on an ongoing basis, in the manner of a complex adaptive system. As skill levels become obsolete within years, employees must be able to constantly learn new skills and "re-invent" their jobs. Large organizations must learn how to integrate knowledge from its diverse fiefdoms in self-adapting, dynamic ways.

The most profound impact of information technologies, therefore, may be that they stimulate us to devise new organizational models for understanding business. Conventional models of productivity predicated on more static economic conditions may seriously misrepresent today's marketplace realities. What is needed are theories that see business activity as a dynamic, flexible enterprise whose ongoing co-evolution can be greatly assisted by information technologies. Information technology is simply a catalyst.

C. *The Human Factor in the Information-Intensive Workplace*

One reason why old methods of productivity measurement are so inadequate is that they usually do not take account of the human factor. Rigid, static measurements often do not consider how well managers and employees "interface" with an information technology. Nor do they consider how well a firm integrates its internal management of people with its external adaptations to the market. These issues are of growing importance in today's more volatile economic environment.

Indeed, virtually all conference participants agreed that the unpredictable, changing nature of today's economy requires that businesses must transform themselves into "constant learning environments." The traditional corporate structure based upon hierarchies of function and boundaries separating people will have to give way to a more flexible environment of self-directed specialists working with each other. This is not just a matter of corporate enlightenment, most observers agree, but a matter of survival in a fast-changing global marketplace.

The introduction of new information technologies will assuredly create new tensions and disruptions for employees. When one specialty semiconductor company introduced portable computers to its mobile sales force, for example, half the staff had trouble adapting to the more information-driven sales protocols that were developed, and eventually quit. In other companies, employees are often threatened by the relative lack of structure and increased freedom that information technologies can bring; they want a more "enclosed" framework of responsibilities and clear external leadership. On the other hand, many employees thrive in a more open, autonomous environment and find great satisfaction in being more empowered on the job.

As this suggests, management must pay greater attention to matching suitable employees to suitable jobs, and to "growing" people to thrive in a given work

environment. A key task of management is how to enlist the fullest capacities of "whole individuals," rather than merely exploit a narrow band of skills while failing to elicit any passion or energy. Thus, to ensure a work environment that is both satisfying to employees and responsive to the marketplace, education and training are becoming more critical to a company's long-term competitive strength.

As John Seely Brown, the Chief Scientist and Director of Xerox Corporation's Palo Alto Research Center, explained, "Learning is incredibly important in business because the skill base today lasts only three to six years. An organization's workplace must allow for constant learning to take account of the world." A firm must be structured not just for making products, said Brown, but also for "making sense" of a changing environment. It becomes imperative that management *listen* in the most receptive ways possible to all parts of its organization and to the world.

Building a more healthy and market-responsive enterprise, in short, requires a corporate culture that honors teamwork and open communication. Information technologies are an integral part of this reconfiguration of the workplace.

The terms under which employees are empowered or not by the new technologies can be decisive in their efficacy, however. Will the new systems be used to centralize management control over employees, de-skilling jobs and introducing electronic monitoring of employees? Or will they be used to carve out new, decentralized spheres of autonomy for employees, who can be less closely supervised by senior managers? MIT Professor Malone sees a complex and paradoxical combination of centralization and decentralization:

> Because information can be distributed more easily, people lower in the organization can now become well enough informed to make more decisions more effectively. At the same time, upper-level managers can more easily review decisions made at lower levels. Thus, because lower-level decision makers know they are subject to spot-checking, senior managers can retain or even increase their central control over decisions.

One of the first, most obvious uses of information technology has been to eliminate bloated layers of middle management. Oddly enough, a new corps of middle managers often springs up to replace the old ones—a dynamic that Dr. Gell-Mann blames on the inexorable "power law" of complex adaptive systems. The resurrected managers are not redundant, however. They are usually taking on entirely new tasks that were previously not possible. Information technology in this way creates entirely new organizational *capacities*.

John R. Oltman, Chairman and CEO of SHL Systemhouse, Inc. believes that information technologies such as interactive voice exchange and e-mail "greatly enhance the capability of people-intensive organizations to move more swiftly to fulfill their missions." It is true that the technology can be used to spread rumors or in other ways misused; it also requires a certain discipline if it is to be used properly and effectively, he acknowledged. Yet for those enterprises that integrate that discipline into the business process, information technologies can help a greater

number of people in diverse locations act rapidly in executive decisionmaking, Oltman said.

Group dynamics within corporations are changed, sometimes dramatically, by the introduction of electronic mail and other information systems. For example, e-mail can give every employee access to any decisionmakers in the corporate structure; communications can become remarkably egalitarian and open. Many employees find it quite liberating to be able to freely express themselves without flouting symbols of hierarchy and authority. This helps account for the prevalence of passionate mail that often erupts on e-mail; people feel they can be more spontaneous and candid about their work concerns.

On the other hand, e-mail can sometimes inflict a crushing information glut on employees. One apocryphal story claims that a woman who returned from a three-month leave of absence discovered 40,000 messages in her e-mail. E-mail can also intensify the volatility of moods within an organization. Everyone can communicate more quickly, which means that rumors and bad news can more rapidly snowball out of control. A big challenge is to ensure that information technology is used to help corporate cultures self-adapt toward positive ends.

The ways in which e-mail have evolved as a communications tool within organizations illustrates the importance of "implicit" human uses. It is a mistake, warned John Seely Brown of Xerox, to conceive of e-mail purely in terms of its explicit functions—can it do x or y? Rather, the implicit human context in which a technology is deployed must be given full consideration. Typically, fluid communities of people informally shape technologies to suit *their* uses. They *enact* new genres of communication; the technology cannot be summarily imposed.

Similarly, informal communities of practice are an important complement to formal modes of instruction. The folk tales and war stories that are informally shared within a group serve as a kind of "cultural DNA" that is at least as powerful as any information technology introduced into a workplace. Unfortunately, the functioning of informal, self-organizing communities of practice are below our customary level of analysis despite the enormous influence such communities have in how a technology is actually used, Brown said.

Understanding this basic fact goes a long way toward ensuring the effective deployment of information technologies. People-to-people interactions are the central fact of the communication, Brown suggests, rather than the technology alone, in isolation. This dynamic can be found in the use of fax communications as well. Having some personal familiarity with a person to whom you are sending a fax or e-mail message can greatly enhance the quality of communication, noted Professor Malone. "The better you know someone," he said, "the less 'bandwidth' you need." William Janeway, Managing Director of E.M. Warburg, Pincus and Co., Inc., elaborated: "The 'virtual coffee machine' is neither possible nor desirable." E-mail is useful in sharing specific facts, said Janeway, but it cannot effectively convey more elusive information such as "how," "whether" and other types of informal, connotative expression.

One of the most fruitful avenues of innovation for information technologies lies in this area of human interface. Bill Joy, founder of Sun Microsystems, Inc., said

New Forms of Community in the Information Age?

By making possible entirely new forms of interpersonal relations, interactive communications systems are creating entirely new forms of community.

As cellular phone and portable computers get even smaller and lighter, Bill Joy, founder of Sun Microsystems, foresees a day in which "temporary aggregations of people will come together via mobile digital telecommunications"—a concept he calls "nomadics." Joy suggests that person-to-person (rather than location-to-location) communications will become more common, facilitated by personal identification numbers.

For Barry A. Berkus, AIA, Founder and President of Berkus Group Architects, information technologies hold great promise in improving architectural design and urban planning, and thus the very structures that foster a sense of community. For example, planners could help arrest urban sprawl by making "data banks," or "physical ledgers," of a city's assets—its air space, zoning rights, land inventory, and human resources, etc.—which could then be used in more deliberate and productive ways. Berkus also envisions more public/private joint ventures in rebuilding public infrastructures; the elimination of walled compounds and the rise of more public spaces; and new building structures that combine work and living spaces. Information technologies could also be used to create "sustainable villages" and to allow more tele-commuting.

Information technologies may also spur the rise of more "geographically distributed" organizations and communities, predicts Dr. Murray Gell-Mann. For example, the MacArthur Foundation has helped assemble networks of researchers who electronically "meet" and collaborate in "institutes without walls," notes Gell-Mann.

For all of their great promise, information technologies may not necessarily enhance our sense of community, warned Professor Stefano Rodotà of the University of Rome. Television's role in fostering social fragmentation and citizen apathy is instructive. "People are losing interest in the political process and participation," Rodotà noted. This has alarming implications for representative democracy, which "assumes the idea of a unified community, which does not really exist any more."

Can this trend be arrested by one often-proposed solution, the "electronic town meeting?" Such meetings, if used for direct plebiscites, too easily lend themselves to oversimplification and demagoguery, noted several participants. They can facilitate emotional manipulation that short-circuit an ongoing, rational process of democratic dialogue. On the other hand, "electronic meetings" can be constructive if they are structured to foster an open, genuine exchange of ideas. The emphasis should be on dialogue and debate, not yes-or-no decisionmaking, which is best pursued in more deliberative, representational forums.

that the technology must be made more user-friendly and more relevant to the specific needs of organizations. One promising strategy, he said, should be the creative use of graphic images as part of the system design. Without this sort of adaptation, he warned, "we are just propagating a ledger and a notebook."

John Hiles, Vice President and General Manager of the Business Simulation Division of MAXIS, Inc., emphatically agreed. His company has built a growing niche in the software business by creating computer simulations games that are both entertaining and instructive. One of his most popular products, "SimCity," allows users to design cities which are then beset by such problems as fires and earthquakes. Another simulation, "SimRefinery," provides an interactive visual simulation of an

oil refinery at work, visually illustrating the consequences of various decisions in its design and operation. Hiles cited a quotation by Albert Einstein: "If I can't picture it, I can't understand it." That is essentially the theme of a useful book on this topic, *Visual Thinking*, by Rudolf Arnheim.

The introduction of new information systems can implicate workers' political interests in ways that may or may not be addressed. Until the 1970s, trade unions generally held power to negotiate the terms under which new technologies would be introduced, noted Professor Rodot, Vice Chairman of Italy's Council of Deputies and a law professor at the University of Rome. Now that power is waning, who if anybody will represent the collective interests of workers? he asked. The answer to this question may influence whether new technologies are used to de-skill and export jobs, or help make jobs more challenging and satisfying.

Clearly, information technology can be used to empower workers and increase their sense of participation; it can facilitate an "adhocracy" of self-directed specialists; it can make possible new forms of collaboration and help generate new knowledge and insight.

One indispensable role for information technology, however, is to provide a reliable feedback loop. The more that a company knows how it is satisfying the needs of its own employees, consumers, suppliers and society at large, the more capable it is of responding to changing circumstances—as suggested by Gell-Mann's theory of complex adaptive systems. If the technology is not used to distribute a sense of "outcomes" to all levels of a workforce—but instead serves to isolate and de-skill people—it is not serving that organization's long-term co-adaptive, co-evolutionary needs.

III. The Process for Moving Forward

In contemplating the future of information technologies, a vital question is not only the vision for the future but the means by which we strive to achieve any vision. This section considers three different vehicles, or processes, for managing change: the free market, government policies, and co-evolution through complex adaptive systems.

What are the advantages and disadvantages of each process? What values are implicit in each? The conference discussion yielded no conclusive answers, of course, but it did offer some useful ways for conceptualizing how new information technologies might be guided into the future.

A. *Let the Market Decide?*

A pivotal question is deciding which set of institutions will provide vision and leadership—the marketplace or government? There are forms of creative cooperation between government and the market, of course, which can help us avoid such a stark choice. Nonetheless, it is important to recognize the values that are more likely to be advanced by one or the other choice.

Bill Janeway of E.M. Warburg, Pincus & Co., Inc., noted that since the advent of liberal society more than 200 years ago, there has been a constant tension between

market institutions and the democratic political process. The former is chiefly concerned with economic efficiency and wealth-creation for shareholders; the latter is chiefly concerned with social equity and well-being for the general public.

While government clearly has a role to play, is it capable of forging a bold vision and mobilizing Americans to make a long-term investment for the commonweal? Historically, Janeway observed, national defense has been the only cause sufficiently powerful to mobilize our nation to achieve a consensus for change. He cited two notable examples—construction of the interstate highway system in the 1950s, mandated by the National Defense Highway Act, and the education reforms of the 1960s, mandated by the National Defense Education Act.

But given the end of the cold war and the conspicuous absence of an external enemy to activate people, what will be the impetus today for building an ambitious new infrastructure of information technology? Janeway said that if a rationale for social investment is going to be fashioned out of the perceived requirements of economic competitiveness, it will first require political leaders who believe in the legitimacy of (non-military) public policy. This will require a radical break with the guiding ethos of the past twelve years, he said.

One of the most ardent proponents of the free-market leadership is George Gilder, who issued a stirring manifesto for unleashing the private sector in the March/April 1991 issue of the *Harvard Business Review*. Gilder argues that the most urgent challenge is to "move the entire realm of telecommunications to an integrated digital environment, both wired and wireless, suitable for the computer age." If achieved, he predicts that the "telecomputer will change the business environment far more than television did forty years ago" and rival the transformative impact of the automobile.

The biggest obstacle to this vision, asserts Gilder, is an obsolete regulatory framework "conceived when information technology was seen as a hierarchical force and telecommunications was feared as a 'natural monopoly.'" In short, government must get out of the way and allow the regional Bell companies and others to build a national fiber optic infrastructure. Gilder's assumption is that telecommunications capacity will elicit its own demand, generating a dazzling array of economic, social and personal benefits.

In its capacity to create the ground rules for markets and as a major user/consumer of information and communications, government is, as Gilder implicitly admits, the most important decisionmaker here. The most significant issue may be the nature of government supervision of the marketplace or, indeed, its capacity for catalytic leadership. Yet at a time when government at all levels is paralyzed by competing political interests, such bodies as the Congress and Federal Communications Commissions may have trouble articulating a bold national vision, especially if it might involve short-term sacrifices for anybody. This naturally provokes the question. . . .

B. *What Role for Government?*

Perhaps the most striking instance of government making a bold national commitment to a new information technology is Minitel, the information services network instigated by French Telecom, the government-owned telecommunications

monopoly. It is worth examining this unusual venture for what it says about the dynamics of government leadership in telecommunications.

Since its conception in 1978, Minitel has distributed for free more than six million terminals to any French telephone subscriber who wanted one. More than 17,000 information programs are available via Minitel; some 55percent of its users are professional. The entire system has been installed without government subsidy. Financing has come from the ongoing revenues of France Telecom—to date, $1.5 billion, $900 million of which has paid for free terminals.

Marie-Monique Steckel, President of French Telecom, Inc. of America, concedes that Minitel is not yet a commercial success; a return on investment is not expected until 1995, seventeen years after the project was initiated. On the other hand, Steckel noted, Minitel is a stunning *national* success in the sense that it helped bring French society into the computer age. The full range of indirect benefits to French culture and industry is difficult to grasp. Two clear benefits that she credits to Minitel, however, are enhanced business productivity and the creation of 25,000 new jobs.

The Minitel experience seems to inspire a strange mixture of admiration and disdain among Americans. On the one hand, Minitel represents a remarkable mobilization of resources to achieve an important national goal; French society is clearly better off because of it. On the other hand, Minitel does not really satisfy the marketplace imperatives that Americans presume should govern such ventures. And U.S. government leadership for such a venture would be considered either ill-advised or politically impossible.

One reason that such leadership has not occurred in Congress, said U.S. Representative Howard Berman, is because policymaking is overwhelmed by special-interest pleadings and Members' own political sensitivities: "Do you want to anger newspaper publishers, who are scared to death about the phone company getting into electronic advertising? Or do you want to get all those people who work for the phone companies mad?" Because of such pressures, few people within Congress are trying to formulate a national telecommunications policy on the merits, said Berman. One problem is that there are few informed, independent voices being heard.

An equal problem, said Michael Fields of Openvision Technologies, Inc., is that "we tend not to compromise for the sake of society. We compromise for our own self-interests, which then leads to the least common denominator policy solution." Fields argued that competing interests need to learn to collaborate more in order to advance a larger public interest. But such compromises, Bill Janeway pointed out, tend to occur only when national defense interests are perceived to be at stake.

Instead of a mushy split-the-difference compromise which leaves no one happy, MIT Professor Thomas Malone suggested that perhaps there are creative ways to realign interests into a new, more constructive paradigm. "Compromise" is a tainted term which can simply mean the postponement of an ultimate reckoning between warring interests, he said. But if divergent interests can be realigned so that all parties have a stake in a common vision, real progress might be possible. In France, for example, Minitel gave newspaper publishers a free hand in developing electronic advertising—a concession that gave them a real stake in the success of Minitel.

Business contracts often exemplify this problem, said Morton H. Meyerson, Chairman and CEO of Perot Systems. They are often written with each party having conflicting structural interests. When one party is being paid by the hour, for example, he has a structural incentive to work as many hours as possible—which clearly works against the interests of the payer. No compromise over the hourly wage will resolve this structural conflict; what is needed is a contract that realigns the interests of both parties.

The discipline of conflict resolution has a term to describe the creative realignment of competing interests—"algorithm"—said Dr. Frances Forde Plude, Associate Professor at the S.I. Newhouse School of Public Communications. A formula with an imaginative re-configuration of structural elements, rather than a compromise that "splits the difference" and fails to address the deeper conflicts, is needed. In a practical sense, an "algorithm" does not require only a new analytic framework for resolving a conflict; it also requires leadership that can use a new vocabulary and imagery to re-cast the emotional terms of a dispute.

Unfortunately, such re-structurings of interests can be very difficult to achieve at a time of stagnant or declining economic growth, Bill Janeway noted. The sacrifice of one party's interests over another's cannot be absorbed by the surplus generated by growth; it must come at the expense of someone else, and thus there is more visible, keenly felt pain.

Providing strong but responsive leadership under difficult circumstances underscores the need for a robust democratic process. Top-down leadership and visions for technology may or may not serve people's actual needs. Leadership that ignores people's sensibilities and fails to earn their consent will almost certainly generate a backlash.

Barry Berkus, the architect, recommended the architectural practice of hosting "charettes" designed to ascertain community needs and desires, and to foster a collective pride of authorship. "By working with people," said Berkus, "it becomes much easier to move forward quickly." The leader in such scenarios is a "facilitator" who brings forward a thought and helps a group actualize it. Electronic town hearings may be one way to host such a process. Another may be computer simulation technology, which is fast becoming more sophisticated and customizable. If the proper assumptions can be built into such software, people could acquire a more image-specific and complex idea of the likely consequences of their decisions.

C. *The Promise of Complex Adaptive Systems*

To commit oneself to either a market- or government-driven process for change, in a mutually exclusive fashion, may be too simplistic. Perhaps, suggested Dr. Gell-Mann, the most important need is not for a fixed vehicle for change—a government law or program or business product or service—but a "locus of activity." He explained that the real need is for a *process* for learning how to cope with change, not necessarily light leadership. What is most needed, Dr. Gell-Mann said, is not a vision *per se*, but a "meta-vision."

If this is true, solutions will be found in variable, *ad hoc* processes that allow our society (or businesses or schools or government agencies) to co-evolve into the

future in the manner of a complex adaptive system. "Create genetic variation within communities and a minimal set of principles," said Dr. Gell-Mann, so that communities can do things on their own. Then provide cross-linkages of information so that these communities can share their ideas and "best practices."

There must be internal principles of organization, he warned. For example, there must be interactions between one level of organization with all others, so that each community has the possibility of adapting into a higher level of organization. To Dr. Gell-Mann, the challenge is to create a process that enables institutions and people to co-evolve and co-adapt, so that there is no need for a top-down leadership structure.

In this sense, it may be helpful to see the democratic process itself as a kind of complex adaptive system. The federal constitution is a framework that allows for a great deal of innovation within broad parameters, depending upon the evolving exigencies of public opinion, economic need and social mood. And state governments themselves can act as "laboratories of democracy," in Justice Brandeis' phrase, which in turn affect the federal government. As long as participation is dynamic and widespread and forums for open communication exist, a democratic society can more easily evolve in nonlinear, highly complex ways toward outcomes that are not intuitively obvious.

There is a paradox in this approach to change, however. We are inclined to use a self-adapting complex adaptive system to achieve a given goal. But the very definition of a complex adaptive system is that it moves toward destinations that cannot necessarily be conceived or understood as yet. Tempting as it is to promulgate a bold "we will land on the moon" vision, there is also a powerful logic for decentralized flexibility and co-adaptation. Imagine the magnitude of error that would have been made if the United States had committed itself to the restrictive high definitive television standards that Japan and Europe adopted.

The existence of a complex adaptive system does not obviate the need for strong leadership, of course. We remain thinking, intentional creatures whose energies need to be focused, led and orchestrated. In addition, we need leadership with a human face and engaging visions. If people are to be galvanized to pursue a given vision for our society and the role of information technology in it, that vision must be communicable through stories and imagery, and not abstract arguments alone.

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APPENDIX B: Communications and Society Program Statement

The Aspen Institute's Communications and Society Program seeks to advance communications and information policy-making to the greatest benefit of society. The specific purposes of the Program are (1) to provide a neutral forum for divergent stakeholders to assess the impact of the communications and information revolutions on democratic institutions and values, (2) to help bring about integrated, thoughtful, value-based decision-making in the communications and information policy fields to cope with problems and challenges of the late 20th century and beyond, and (3) to offer, when appropriate, recommendations of policies and actions at local, state, national, and international levels. The specific issues that the Program seeks to explore in 1993 fall into the four categories listed below: communications policy-making, communications for social benefit, communications and education, and communications for global understanding. The subject areas are not mutually exclusive. Recent and future project titles are listed below:

1. COMMUNICATIONS POLICY

- Democracy in the Information Age (annual subscription seminar)
- Electronic Media Regulation and the First Amendment (1990)
- Television Coverage of Campaigns:
  Models and Options for the Commission on Television Policy (1990)
- Annual Telecommunications Policy Conference
  1991 – Towards Consensus on American Telecommunications Policy
  1992 – Competition at the Local Loop: Policies and Implications
- Communications Counsel's Forum: A Preliminary Review of the Communications Act (1991)
- Computer Research Policy Summit (1992)

2. COMMUNICATIONS FOR SOCIAL BENEFIT

- Online for Social Benefit (1989)
- SeniorNet Services: Towards a New Environment for Seniors (1991)
- Television for the 21st Century: The Next Wave (1992)
- Assessing the Public Broadcasting Needs of Minority and Diverse Audiences (1992)
- The Information Evolution:
  How New Information Technologies are Spurring Complex Patterns of Change (1992)
- Toward a Democratic Design for Electronic Town Meetings (1992)

3. COMMUNICATIONS AND EDUCATION

- Defining Education's Role in Telecommunications Policy (1991)
- Telecommunications as a Tool for Educational Reform:
  Implementing the NCTM Mathematics Standards (1991)
- Media Literacy: Definitions, Visions, and Strategies for the 1990s (1992)
- The Aspen Forum on Telecommunications and Education (proposed)

4. COMMUNICATIONS FOR GLOBAL UNDERSTANDING

- Television News Coverage of Minorities:
  Models and Options for the Commission on Television Policy (1992)
- The Writer as a Conscience of the World — 1993 Jerusalem International Book Fair Aspen Forum

The Aspen Cube: A Three-Dimensional Roadmap for Communications Policy Issues

The field covered by The Aspen Institute's Communications and Society Program is vast, but the many issues it covers can be defined and interconnected by means of a three-dimensional matrix, a kind of Rubik's Cube of the Information Age. Along one axis are characteristic trends of the Information Age, which will vary:

Digitization and Convergence
Competition
Artificial Intelligence
Deregulation
Interactivity and User Control

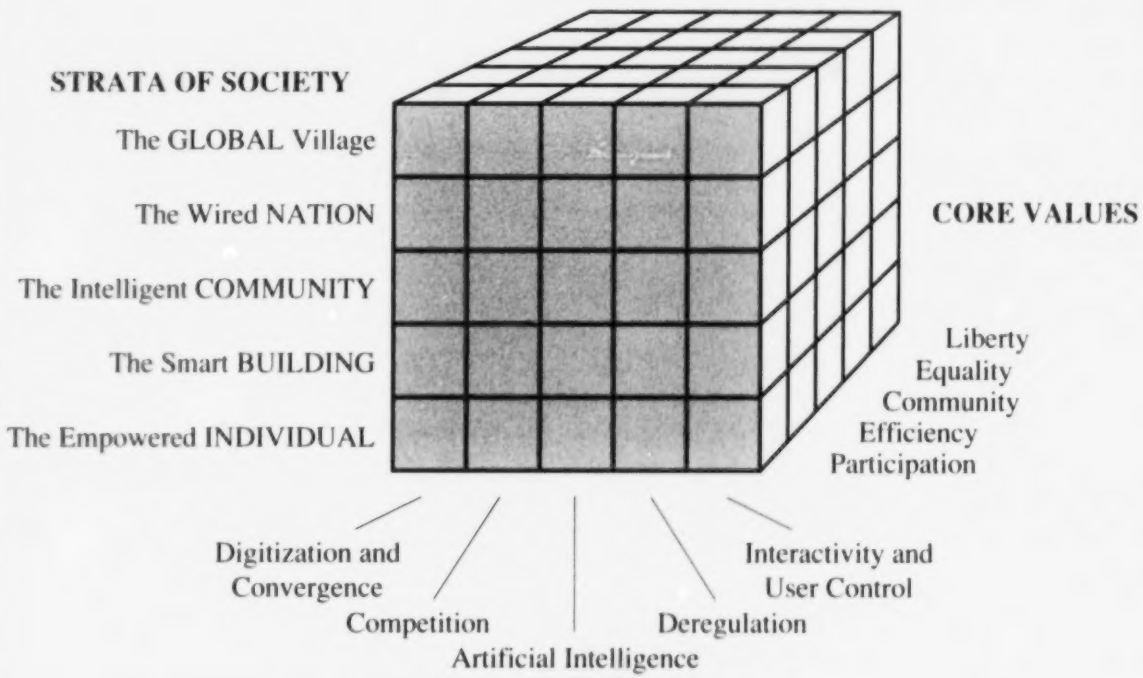
Across another side of the matrix are the strata of society from which one should view the issues, viz., international; national; community; home, school, or office; and the individual. We use labels that have entered the vocabulary from the Communications Revolution:

The Global Village	*The Wired Nation*	*The Intelligent Network*	*The Smart Building*	*The Empowered Individual*

The third side of the cube lists the values that are most associated by the new communications media, structures, and institutions. This list, too, can vary. Our present approach looks at:

Efficiency (including Privacy and Free Speech)
Equality (including Universality and Equity)
Community (including Diversity and Quality of Life)
Efficiency (including Productivity)
Participation (including Access)

This construct can be pictured as a cubic matrix. From any particular point or cube within the matrix, one can move along any or all of the three axes, connecting technological trends, strata of society, and values.



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Publications Office
P.O. Box 150
Queenstown, MD 21658

#93W-601

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